CAREERS IN ENGINEERING

UNIVERSITY OF ILLINOIS BULLETIN 1965–1967

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CAREERS IN ENGINEERING

A GUIDANCE PUBLICATION FROM THE COLLEGE OF ENGINEERING AT THE UNIVERSITY OF ILLINOIS, URBANA

PREVIOUS EDITIONS · 1949, 1951, 1952, 1954, 1959, 1961, AND 1963.

CONTENTS

The direction in which
education starts a man will
determine his future life.

PLATO

PART I · THE TIME FOR DECISIONS IS . . .

Researchers from the Caordinated Science Labaratary, University af Illinois, launched this Nike Apache Rocket ta take measurements in the ianasphere. The Nike Apache is a two-stage rocket thot will reach an altitude of 110 miles.

. . . NOW

There was a man who wanted to swim across a lake. He got two-thirds of the way across and decided he couldn't make it. So he turned around and swam back.

The story shows quite a bit about people. Poor judgment and misunderstanding can cause failure, twice as much work, and take twice the time as knowing what to do, how, and when. This book is designed to help you get "clear across the lake" by giving you correct information about engineering careers before you have to commit yourself.

You should consider problems of career and college by the seventh, eighth, or ninth grades. The choice of high school courses will greatly affect your life. It is becoming increasingly difficult to enter college, especially if you have not taken and done quality work in the proper college preparatory courses. If, when you're in high school, you take a basic college preparatory course — four years of English, four years of mathematics, at least two years of a foreign language, two or more years of science, and *if* you do well in them — you will probably be qualified to enter the college of your choice.

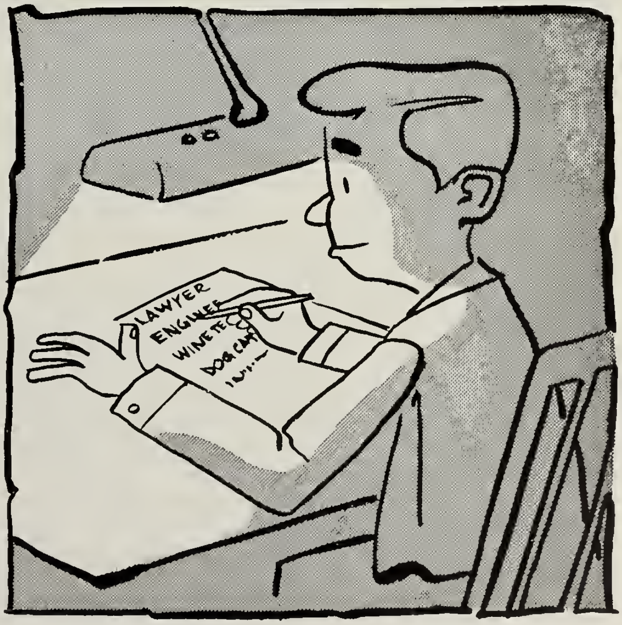
If you think you want to become an engineer or scientist, it is important that you take four years of mathematics and two or more years of science (not general science, but physics and chemistry and whatever advanced courses your high school offers).

You may be aware that high schools offer many activities that will also affect your decision for a career. There are clubs you can join; for instance, the FFA (Future Farmers of America), the FTA (Future Teachers of America), the JETS (Junior Engineering Technical Society), and others. Your high school may also have a "Career Day," when men and women from almost every career will come to your school and talk about their work. Be sure to take advantage of this opportunity; ask these people all the questions you find necessary; take home and study the pamphlets they distribute.

How can you decide on a career? The first thing to do is to think about yourself. What classes do you like the best? In what subjects do you get the best grades? What kind of homework do you really enjoy doing? List your preferences on a sheet of paper; call it "What *I* Like" and add to it every time you remember or discover something new.

You could start another list: call this one "Careers That Sound Interesting." On this list, include the careers you think you would enjoy. If you have only a few careers on your list, talk with friends, relatives, neighbors, and teachers (and the people who visit you on Career Day) about their work. When one of these sounds interesting, add it to your

Start another list: call this one "Careers That Sound Interesting." Include the careers you think you would enjoy.



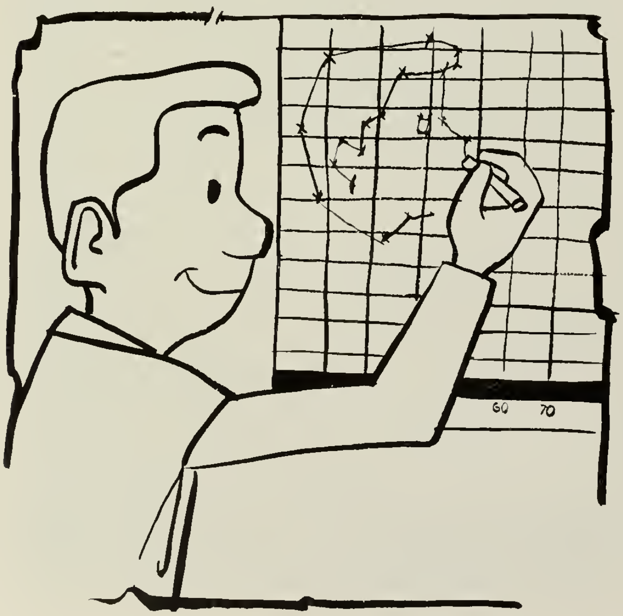
list. The world is full of interesting things to do and most of them need special preparation, usually over a long period of time. Find as many booklets — such as this one — as you can on every career.

Now, compare the lists. Try to match your strong interests with the careers that would suit them best. If your interests are science, mathematics, and other technical subjects, you will probably keep engineering, science, medicine, dentistry, and other careers involving technical interests on your list.

You can take tests in high school to help you get a picture of yourself. These will indicate where you have talent and ability. If you would like to know the answer to the question "do I have engineering aptitude?" you can write for the booklet of that title. Write to Engineers' Council for Professional Development, 345 East 47th Street, New York, New York 10017, and ask for "Do I Have Engineering Aptitude?" — the questions and answers in this booklet should help you decide if you would be a successful engineering student. Many colleges will also be able to give you some tests; some of them are free, if you plan to attend that college.

Use judgment in all the material that you read, and with all the people with whom you talk. You will find people who tell you not to enter a particular field for some reason or another, often based on their personal likes or prejudices. But if you have talent, and if you have real strength of character, you will most likely succeed no matter how difficult it may seem.

You can take tests in high school to help you get a picture of yourself.



Some other serious considerations for you to think about when deciding upon a career: How much education is necessary for each type of work? What type of industry or organization offers positions in each field? What is the main responsibility in that field? How many people have already chosen that career? (Get up-to-the-minute information; this will let you know what the competition will be like.) And, very important, will you be happy doing that kind of work, day after day, for the rest of your life?

Take time to make the decision. Certainly you can't make it in one day or even a week. One thing is certain though; you should decide by your freshman year in high school if you want to go to college. A good college preparatory course will be a good basis for any field. If you do want to go to college, and if you want to be an engineer, you are going to need all the science and mathematics you can take in high school.

If, after reading this book, you think you might become an engineer, join or organize a JETS chapter in your school. Participation in such a group will help you evaluate your abilities and interests. Information about JETS may be obtained from the Executive Director, JETS, 345 East 47th Street, New York, New York 10017. In Illinois, write to the State Director, JETS, 313 Transportation Building, University of Illinois, Urbana 61803.

Do you have to decide right now what kind of engineer you'd like to be? No. You can think about that while you're in high school and for the first year of college. You usually need not specialize in any branch of engineering until your sophomore year at least; even then the difference in the programs is so small that it is still possible to change. You may be asked about your field of interest when you enter college, but your answer does not force you to follow that course of study.

P. S. IF YOU'RE A GIRL

If you have done well in science so far, and if you enjoy high school physics, chemistry, and mathematics, you should consider engineering as a career. Women find many opportunities in engineering, since this profession does require mental — rather than physical — strength. Many women are entering the engineering colleges and making careers in engineering.

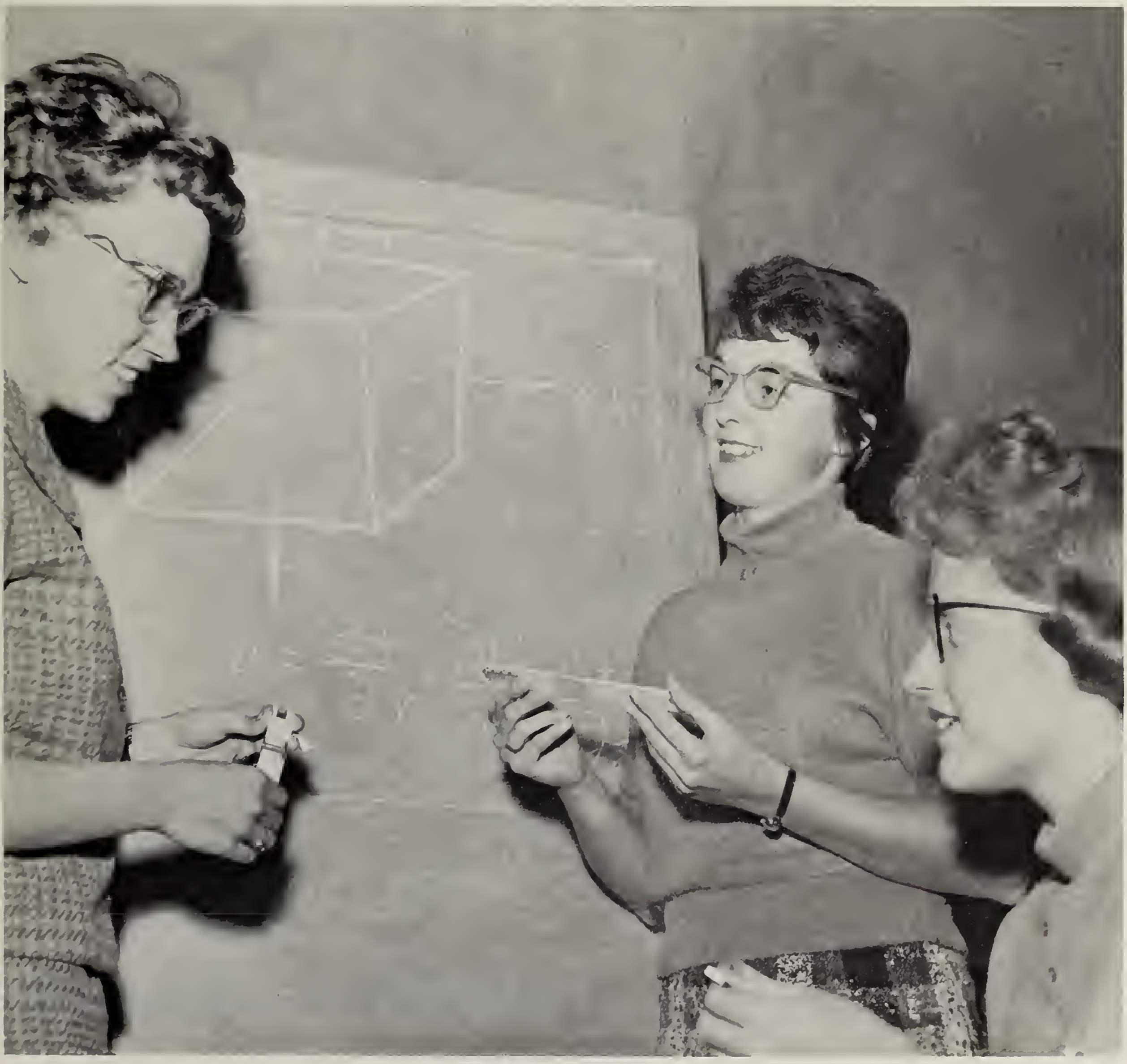
The Society of Women Engineers published a small booklet called "Profile of a Woman Engineer."

The average woman engineer is described as "between 36 and 37 years old. She is equally likely to be married or single, but if married has three children. She is employed by industry and earns a median salary of between 9 and 10 thousand dollars per year. A college graduate, she has a bachelor's degree in engineering or one of the physical sciences and either has a graduate degree or has taken specialized training, related to her work, at the graduate level. She is a member of one or more of the technical societies. She is unlikely to be a licensed professional engineer."

As for today, the Society points out that "The beginner of today faces an exceptionally bright future, and we believe with certainty that there is every reason to encourage her in the preparation for and pursuit of a career in engineering or the related sciences."

Fewer than 5,000 women engineers are practicing in the United States today. The Society of Women Engineers recently published a report entitled "600 Women Engineering Graduates." Some of the results from this study are shown on the following page.

These young women have chosen to become engineers. They are shown here discussing a problem assigned in a physics course at the University of Illinois.



43% — employed full time
10% — employed part time
47% — not employed (most of these have small children)
20% — single
80% — married, with an average of 2 children (4, 5, 6 not uncommon and even 7, 9, and 11 being listed)
55% — of those married have husbands who are also engineers or scientists
39% — have done graduate work
40% — belong to professional technical societies
10% — are Registered Professional Engineers (PE)
5% — are Engineers-in-Training (EIT)
68% — of those not working are interested in retraining programs

For more information, including the booklet "Women in Engineering," write to the Society for Women Engineers, United Engineering Center, Room 305, 345 East 47th Street, New York, New York 10017.

. . . WHILE YOU'RE IN HIGH SCHOOL

When you are about halfway through high school in a college preparatory program, you should begin to investigate different colleges so you can make an intelligent decision about which one to attend.

As a "pre-engineering" high school student, one of the most important qualities to check when you are "shopping" for colleges is whether the curriculum is accredited by the Engineers' Council for Professional Development (ECPD). ECPD is an organization made up of representatives of the top engineering societies. This Council examines each degree program of a college of engineering (or institute of technology) to determine if it meets certain minimum requirements. If it does, it will be accredited — or recognized — by the Council. Approximately 175 colleges of engineering and institutes of technology in the United States have curricula accredited by the ECPD. A number have not been accredited.

You should also find out what kind of staff, laboratories, classrooms, and libraries each college has. Educational institutions vary in many areas: entrance requirements, climate, housing, extracurricular activities, standards of scholarship, costs, and others. These aspects of college should be considered when you make your decision. An excellent way to judge an engineering school is by the opinion practicing engineers have of it.

You may want to compare the staff, curricula, and facilities of different institutions by reading their catalogs. Your high school library, or the high school counselor, may have catalogs. If not, you can obtain them free by writing to the deans of engineering of the institutions in which you are interested.

You may postpone your choice of engineering schools by first attending a liberal arts or junior college that offers a pre-engineering curriculum. The programs of these schools are patterned on the requirements of the standard engineering colleges. However, it usually takes an extra semester or more to complete the college requirements for an engineering degree if you transfer from one institution to another.

. . . WHILE YOU'RE IN COLLEGE

Many engineering colleges and institutes of technology offer master's and doctor's degrees as well as the bachelor's degree. Whether you want to go to graduate school or go directly to work is a decision which can be made when you are a junior or senior in college. At that time, you will be able to discuss the problems and virtues of graduate college with counselors. Many booklets are available on graduate college, including the publication "The Road to Graduate School," printed by the American Society for Engineering Education.

Undergraduate students are checking measurements of a test-specimen for stress analysis.

Scientists explore what is
and engineers
create what has never been.

THEODORE VON KARMAN

PART II · TELL ME ABOUT ENGINEERING

Hydraulic engineers are working with the U. S. Naval Civil Engineering Laboratory in making stochastic hydrodynamic analyses of ocean-wave action on a moored platform ("Fishhook") for underwater missile launching. (Official Photograph, U. S. Navy.)

WHAT IS ENGINEERING?

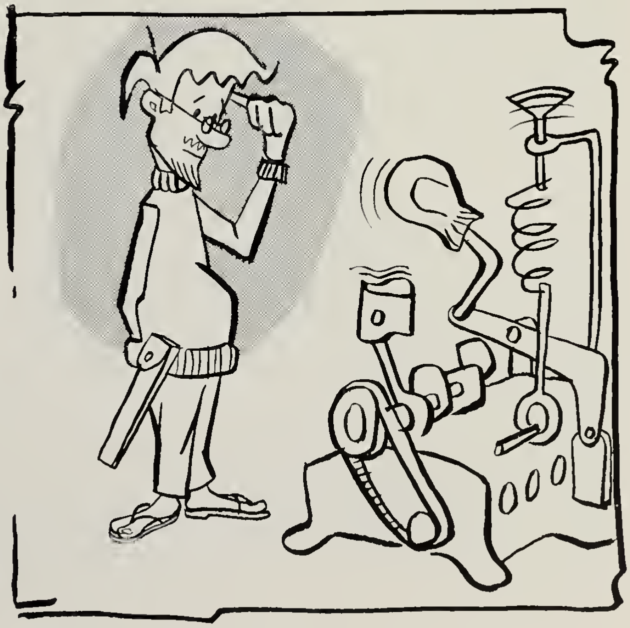
"Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind." This definition was written by professional engineers. It emphasizes that an engineer is a creative man, educated in the physical sciences, and trained to coordinate ideas, men, and money toward his goal of bringing scientific and natural resources to the service of his fellow men. The engineer is a professional man following an old and proud profession. He has a college education, but, most important, he is held responsible for his creations.

The technician is the engineer's assistant. He usually has a two-year training course in a vocational school or technical institute (not to be confused with institute of technology), rather than a four-year degree or additional graduate degrees. The technician is responsible for carrying out the plans and designs of the engineer. He is skilled in his job; he does not, however, need to know so thoroughly the principles underlying the work he does. It is the responsibility of the engineer to have a knowledge of basic science, to exercise judgment, and to take initiative in the creation of new devices and services. It is the engineer who is responsible to society.

You may be thinking "Why should an engineer be 'responsible to society' and just what does that mean?" An engineer must know the principles of physical science; his college and high school education will give him a foundation in that. He must

The engineer is a professional man following an old and proud profession.

The engineer is an individual who combines knowledge of science and other fields with judgment to develop services and devices of practical use.



also know the society in which he lives so that he will understand the impact of his work upon it.

People are often confused about the titles "engineer" and "scientist." Science is a method for learning about the physical world through systematic observation and experiment. Science is also defined as the systemized knowledge of the facts and laws of the physical world. Men and women who work professionally with such knowledge are usually called scientists or engineers.

A *scientist* uses existing knowledge to gain new knowledge. New knowledge is his primary goal; he is not necessarily interested in the application of this newly found knowledge.

The *engineer* is an individual who combines knowledge of science and other fields with judgment to develop services and devices of practical use. He must have imagination and understanding so that he can visualize uses for old and new knowledge (including that of people and costs), to meet current needs of society. If the engineer is directly developing knowledge of the laws of nature, with the intention of applying them, he is a *research engineer.*

Despite the fact that "scientist" and "engineer" have been defined as two separate professions, the two are very close together. You will find it difficult to distinguish between the two since an engineer can and does carry on research, and scientists often work on practical application, particularly in developing the tools by which they can learn more about nature. It is easier to tell when an individual is doing scientific work or performing an engineering function than it is to say "who" is an engineer, and "who" is a scientist. A new group is growing up called "engineering scientists," and in the future, one name may apply to both groups.

WHAT IS AN ENGINEER?

The best way to tell you what an engineer "is," is to explain what an engineer does. Keep in mind that the purpose of an engineer's work is to make the properties of nature *useful to man.*

First, imagine that you are already an engineer and that you have been given a problem to solve. Pretend that you are working for a furnace manufacturer on a heating system which will be better than the old one, as well as safe and economical.

The first thing to do is to study the nature and size of the problem. Then break the problem down into smaller parts. Some of the parts will be technical problems; some will be problems with people (for example, in your heating project you may find that what the average home owner wants and what he can afford are two separate things); almost always another problem will be cost — the less your solution costs when it is put into action, the better.

You will spend a lot of time thinking over the entire problem at this point, weighing the factors and deciding which will be important to your solution. You discard those factors that you consider relatively unimportant, then gather more information on those which are important. During this stage, you will use all the knowledge you have gained from experience, observation, reading, and your own or others' research and experiment.

After you have reached a solution to each part of your project, you bring all the partial solutions together to see if they add up to a practical answer.

This done, you begin all over again if time permits to see if there isn't an even better solution. Engineering is different from mathematics in this special way: there may be several solutions to any given engineering problem. You must use your keenest judgment in choosing the one solution which seems best in view of all the circumstances and factors.

After you have reached a solution to each part of your project, you bring all the partial solutions together to see if they add up to a practical answer.

If the job is very large, you will probably be involved in a team effort in which you will have to solve certain problems; other problems will be assigned to the other members of the group. A project director or chief engineer coordinates the work.

An engineer not only analyzes problems, *he works creatively to find an answer*; he devises a whole new concept. The engineering method is: analyze, evaluate, and synthesize.

WHAT KIND OF PERSON IS AN ENGINEER?

The profession of engineering has many "branches" and many types of people practicing. No *type* of person is an engineer any more than there is one type of person who attends your school. However, here are some traits an engineer should have:

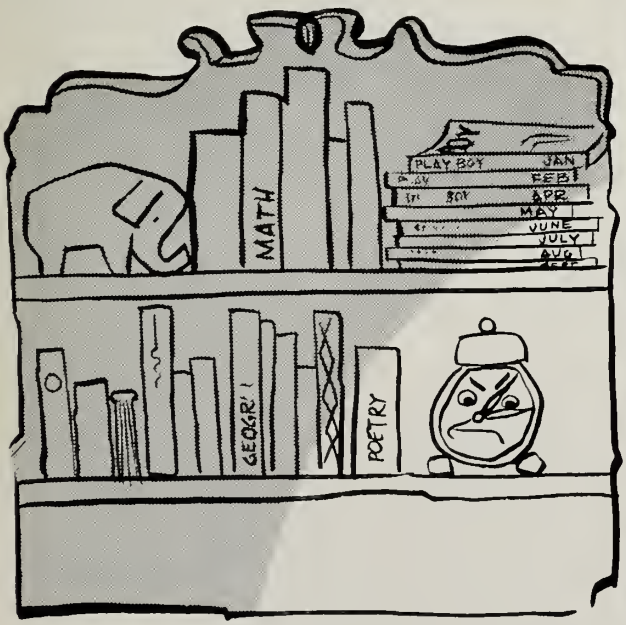
> An engineer should be willing to work hard; he should be able to lead and direct people; he should be agreeable and cooperative; he should be willing to finish a job; he must be honest.

Those character traits probably sound familiar to you; everyone should have them. A person interested in engineering as a career should also be curious about and interested in the properties of nature; he should be able to think logically and should be interested in mathematics (so that someday he will be able to think in "quantitative terms"); he should be able to visualize problems, devise ingenious equipment; he should be able to weigh ideas and make wise, prompt decisions, even at times when he does not have all the necessary information.

WHAT KIND OF EDUCATION DOES AN ENGINEER NEED?

Engineering is an occupation in which the ability to think creatively is more important than muscle (although an engineer may use his muscles or at least his hands once in a while). Therefore, the goal of an engineer's education is to develop his mental ability. Mental ability is not developed suddenly. The development is divided into three stages: the first stage begins at birth and continues through high school. The development is rapidly increased in the college or university and then continues at this stepped-up pace in practice in industry or elsewhere after college. Engineering is not merely a learned profession — it is a "learning profession." An engineer must continue as a student during his entire active life.

An engineer should be willing to work hard.



An engineering student making good use of a free hour.

HIGH SCHOOL

In high school, a person interested in engineering should take courses which will stimulate the development of his mental ability and will be a good background for college. The courses should provide:

A good background in the principles of arithmetic, algebra, plane and solid geometry, and trigonometry.

An understanding of physics, chemistry, and biological science.

A good background in English literature and the English language.

Some knowledge of history, government, and the social sciences.

An ability to study efficiently.

Some students interested in engineering are graduating from high school with too many courses in shop work and not enough in these basic subjects. *It is quite likely that a person who does not meet these qualifications will not be able to enter college until he makes up his deficiencies.*

COLLEGE

Graduation from college does not make a "finished" engineer. However, you should gain all the tools you will need to build a career as an engineer. Your college education will give you many important skills and training that will serve you in your entire career.

Social poise, graciousness, and a pleasing personality will put you at ease in any situation.

Your college education is so important to your development as an engineer that you should understand and appreciate the objectives of your college work. The over-all goals are to gain knowledge, to develop the mental skills necessary for using this knowledge, and to develop the social poise, proper attitudes, and personal characteristics which will enable you to become a successful engineer and a good citizen. The specific objectives are:

I. To Gain Knowledge
   A. Fundamental laws and principles
   B. Factual engineering information
   C. Cultural, sociological, and economic background

II. To Develop Mental Skills
   A. Ease in expressing yourself both by words and by graphs, diagrams, etc.
   B. Ease in visualizing and understanding
   C. Imagination, ingenuity, and resourcefulness
   D. Ability not only to find sources of information, but also to determine which is important and which is not
   E. Ability to think straight, to reason logically from fundamental principles, and to reach correct conclusions
   F. Ability to analyze, evaluate, and synthesize (the "engineering method")

III. To Develop Proper Attitudes and Personal Characteristics
   A. Honesty with facts and men
   B. Awareness of responsibilities of citizenship
   C. Spirit of cooperation with others
   D. Leadership
   E. Industry, initiative, and self-reliance
   F. Confidence in the ability to learn and to carry on individual studies, investigations, or research efforts.

The first group and parts A and B of the second are gained mainly through scholastic work. They are the "end products" of an education. Parts C through F are "by-products" of your classroom work. You will not be given instruction in "imagination, ingenuity, and resourcefulness." You should develop these characteristics without even knowing it, while you study and learn.

The third group is a "by-product" of attending college. Plan to attend church groups, parties, dances, banquets, and school activities such as student council, drama groups, and others. You won't want to do them all simultaneously, or do

them at the expense of your studies, but you will enjoy and improve yourself through contact with fellow students and instructors. You will, in this way, find friends outside the school of engineering, as well as new ones in engineering. Friendships with people in other programs will broaden your interests and give you even better understanding of people. (Many of your contacts after graduation will be with people who are not engineers.)

These outside activities are stressed for two reasons: first, in the past, engineers have sometimes been accused of having little social poise. This broad accusation is not true for everyone, but some engineering students are often so engrossed in their academic work that they miss important social functions of college life. The second reason is that social poise, graciousness, and a pleasing personality will put you at ease in any situation. You will have the "well-rounded" personality that is a great help in becoming a successful engineer and good citizen.

As an engineering student, you will also learn "physical" skills to a moderate degree. Physical skills include drafting, use of instruments and tools, skill in arranging and setting up equipment, and neatness in preparing reports.

If you look back at the objectives, you'll see that part I-C is "cultural, sociological, and economic background." While you are in college, you will take elective courses outside the field of engineering. These will further round out your education by teaching you about the world and country you live in. This is important and cannot be stressed too much for students whose work may affect the lives of every American. Engineering technology occupies a very important place in the economy and lives of every citizen; because of this, every engineer should have a social conscience and awareness.

Elective courses which will develop your cultural background are: literature, fine arts, history, astronomy, and languages; for sociological background: social psychology, sociology, history, eco-

This blowdown wind tunnel serves for the measurement of the flow of a gas-solid suspension through a two-dimensional nozzle.

nomics, political science, and geography; for recreation or a hobby: astronomy, archaeology, zoology, botany, literature, music, and dramatics; to provide knowledge in subjects related to professional work: economics, accounting, psychology, industrial relations, engineering law, technical report writing, and speech; for development of a combination of engineering and another career: business administration, education, law, journalism, and political science.

INDUSTRIAL TRAINING

The final phase of your formal education will come in industry after you have graduated from college. Whether you work in industry or government, whether you receive only one degree or several, you will probably take formal postgraduate training courses. There are many different training programs; some take one year, others take five years and are taught during office hours. Some companies will send you back to college for a higher degree. Most companies arrange for refresher courses, sometimes in cooperation with universities, which you will take periodically to keep up with new developments in your field.

A LIFETIME OF DEDICATION

A while ago, you learned that an engineer's education should continue throughout his lifetime. This is true for almost all occupations, but is especially true for people in engineering and science. As a part of his job, an engineer reads reports on current research in the journals of his profession and elsewhere, and takes courses in subjects that perhaps weren't taught when he was in school. In order to make contributions, an engineer must always be up to the minute in his information. Your teachers will help you while you are in school, but once you are your own teacher and pupil, the responsibility to know will be up to you. It will take a lifetime of dedication to be a good engineer.

This special, high-temperature furnace (maximum temperature of 3400° F.) makes it possible to grow single crystals of carbides.

WHAT IS ENGINEERING REGISTRATION?

An engineer must be licensed (or registered) by the state in which he works if his work affects "the public health, welfare, or safety" or if he advertises his services as an engineer.

An engineer who designs or approves designs for bridges or buildings, for example, affects the health and safety of a community. He must be registered. An engineer who has his own business — or who even uses the word "engineer" on his stationery — must be registered.

Registration protects engineers by keeping the professional and educational standards high. You might want to be registered even if it isn't necessary at the time of graduation, in the event employment or other circumstances change.

Registration as a professional engineer is granted after an applicant passes two examinations. The first one can be taken at about the time of college graduation. The examinations vary from state to state, although they are generally concerned with the theory and principles of engineering. After passing this first test, the young graduate will be certified as an "Engineer-in-Training." After about four years (the time also varies from state to state) the second examination is given to determine whether the young engineer has had the proper amount and type of experience. After passing this test, a certificate as a "Professional Engineer" is awarded by the appropriate state agency. Most states have reciprocal agreements (although there are some important exceptions) which make it possible for a licensed engineer moving from one state to another to receive a license to practice engineering in the new state without re-examination.

A view of the unit operations laboratory of chemical engineering showing equipment for studies of evaporation.

The first engineer moved a rock with a lever;
thousands of years later
increased skill and knowledge permitted another engineer,
working under the same natural laws,
to move man into outer space.

PART III · WHAT KIND OF ENGINEER COULD I BE?

This student is odjusting on orc-heated blowdown wind tunnel for the study af the interactian of dispersed solids with o portiolly ionized gas. He is working in a Mechanical Engineering labaratory.

WHAT KIND OF WORK WOULD I DO?

In your work as an engineer, you will probably be listed three ways: by the type of job you have within a company (e.g., research, test, design, development, etc.); by the number of years of experience you have (e.g., junior engineer, engineer, chief engineer, etc.); and by the type of training you have or the type of problem you work with (e.g., chemical, civil, industrial, etc.).

Some of the types of careers listed below — such as research or teaching — require college work beyond the usual four years. A master's or doctor's degree is generally required in those fields.

An engineer may not actually have performed experiments leading to a discovery, but he is definitely involved as soon as the discovery is considered for practical use, tested, manufactured, and sold. Even after it is sold, engineers may play an important role by providing technical service for the customer.

Let's suppose that we are about to enter a company that has an engineer in every possible engineering function. Since discovery comes first, let's begin by discussing the research engineer. Imagine that the discovery is of a new plastic substance, or an atomic fuel for rockets, or a new computer. Follow it from research to sales and installation as it passes through every engineering function.

The *research engineer* may make the discovery while trying to find the answer to a problem. At any rate, after the discovery has been made, the research engineer will study it in an effort to analyze its practical use. He will study the literature on it, make calculations, and conduct experiments to prove, reject, or modify the existing theories. In this way, he tries to anticipate specific manufacturing problems, develop new equipment, and evaluate theoretical relationships.

The *development engineer* takes the problem from there. He will use the results and discoveries of the research engineer and will convert them into useful products or methods. The result of his work is usually a model which performs the essential functions but may not be suitable for the manufacture of products. He, too, does a large amount of experimental and analytical work in order to accomplish this. He may even set up a "pilot plant" to learn how to produce the new material or device on an industrial scale. Here he will have to work closely with both the research engineer and the design engineer.

After the best practical use of the discovery has been determined, the *design engineer* prepares plans and specifications for the apparatus and projects. He makes more calculations and sketches, writes specifications, selects needed materials, helps prepare the apparatus for testing, and establishes performance standards for the manufacture of equipment or the fabrication of structures. He must be able to visualize what happens during the operation of any piece of equipment, and he keeps up to date on the latest equipment and patents.

The *test engineer* is responsible for the actual testing of equipment, materials, and processes, to find out whether they meet specifications and accepted engineering standards. He may actually set up the test facilities and conduct the tests, or may supervise the testing. The results of his work will provide information from which further modifications or improvements can be made. He will be in frequent contact with the research, development, and design engineers.

After the new product is finally tested and ready for manufacture, the *planning engineer* will select and combine equipment best suited to the new job. He may do this for a plant, or may act as a consultant to the sales department and help select equipment for customers. He should have a good engineering background and the ability to see all aspects of a problem in order to anticipate the developments and needs of the future.

Now the *production engineer* receives the designs and is responsible for the selection and supply of raw materials and for the manufacture of products. He studies the methods, processes, and equipment used in the manufacturing operation. He works closely with the design engineer on manufacturing problems, and keeps in mind the economic factors.

The *construction engineer* supervises the construction of facilities and structures from designs and plans. It is his responsibility to know materials, how to procure these materials, and the proper use of equipment. He will be supervising construction, so it is necessary that he have the ability of leadership and that he be able to work well with others.

The *operating engineer* supervises men and machinery once the product is ready to be made. His job is to see that a task is done safely, efficiently, and without interruption. He may work with a group of machines or an entire plant. Sometimes, he is in charge of obtaining supplies and repair parts, the selection of new equipment, protection and maintenance of equipment, and the direction of operating personnel.

Once the product is manufactured, the *sales engineer* is a most important engineer. He acts as a representative of the manufacturer to the customer. He studies the customers' needs and must know his company's equipment well so that he can explain its design, construction, and operating features. He may, on occasion, negotiate the price of the equipment.

When the product has been sold, the *service engineer* supervises installation and final testing for the customer. He investigates customer complaints and corrects any trouble with the product. Since service and sales engineers both must have good engineering backgrounds, and because both work with the public, many companies combine the two jobs. Engineers are used in sales and service primarily when the product is large-scale, complex equipment or industrial supplies. An engineer would not be used to sell or service ordinary consumer goods.

In a given company, these various engineering jobs may be combined in many ways and may have a variety of names; research and development may go together, for example, or the testing function may be handled by a "quality control" engineer, and sales and service may go together. Do not expect to find the exact names that we have listed here for engineers in every company.

There are many careers in areas related to engineering, but which are not actually part of the engineering function. Three of these are teaching, administration, and publication.

One of the most important needs for the future (and the present, too) is for engineering teachers. As the need for engineers continues to grow, there must be an increasingly large number of competent, well-educated men to teach them. Students with a good scholastic standing and a desire to continue their studies beyond the usual four years may find engineering education an interesting career. This profession requires a person who is interested in young adults and who enjoys continued research, since university research can be combined with university teaching. The doctoral degree is becoming a required qualification for a teaching position.

A career in management (in industry, government, or university) is available to those with a good engineering background. Men who plan such a career often have a bachelor's degree in engineering and an advanced degree in business administration or law.

A career in publications requires the ability to understand technical theory and explanations, as well as the ability to write (or supervise the production of) reports, speeches, or articles for journals, magazines, or newspapers. There is a growing need for people with engineering backgrounds and the desire to write.

Junior Engineer or *Engineer-in-Training* is the title usually given to the young engineering graduate in his first employment.

WHAT WOULD I BE CALLED?

Another way in which engineers are classified is by responsibility and experience. The titles given below are not used by every industry or government agency, but will give you an idea of the general responsibilities and advancements.

Junior Engineer or *Engineer-in-Training* is the title usually given to the young engineering graduate in his first employment. He is under supervision and will most likely be continuing his education. This training will be aimed at learning the demands and procedures of his employer.

After on-the-job training, the young engineer will do technical work and will be called an *Engineer*. He is still under the supervision of an engineer who is responsible for giving him a problem and deciding when a satisfactory solution has been reached.

The *Supervisory Engineer* assigns work and is responsible for the Engineer-in-Training and others. He may be in charge of a group of men or an entire department.

The most responsible of positions is held by the *Chief Engineer* or *Administrative Engineer*. He will have had experience and proved himself to have superior ability. He is concerned with the broad aspects of his company, including decisions concerning policy, personnel, finance, law, and public relations. Many engineers hold administrative positions, up to President or Chairman of the Board, especially in research-oriented industries.

It is not necessary to go through all the steps mentioned above. In some careers, such as teaching, an entirely different promotion scale exists. To hold even the "Engineer-in-Training" position, a bachelor's degree is necessary. Some careers, such as that of a research engineer, require advanced degrees.

WHAT ARE THE MAIN BRANCHES OF ENGINEERING?

Engineering began about 5000 B. C. Engineers designed the pyramids, early irrigation ditches around the Nile, and helped develop early civilization. Then engineering became a military assignment, when men were needed to construct bridges, roads, and other military installations. Later, as the need for non-military structures grew, some engineers left military service to become civilian — or civil — engineers. After this, the scientific and technical knowledge grew too large for one man to know everything, so other engineers divided into new branches.

Even though you will read about the branches of engineering here and in college catalogs, engineering is still a close unity. Engineering freshmen generally take the same courses; the sophomore

The *Supervisory Engineer* assigns work and is responsible for the Engineer-in-Training and others.

The most responsible of positions is held by the *Chief Engineer* or *Administrative Engineer*.

courses are quite similar, too. Then, in his junior and senior years, the engineering student may specialize in one of the branches. Your college education, then, is designed to give you a broad understanding of engineering as a whole, and then permit you to specialize.

An engineer should have a good understanding of engineering, science, technology, and sociology. In addition to understanding engineering as a whole, an engineer may specialize and become an expert in one of the following branches:

1. *Aeronautical and Astronautical Engineering* involves the application of scientific and engineering principles to the research, development, and design required to build and use all types of manned and unmanned vehicles that operate above the earth's surface as well as certain types of marine vehicles. These vehicles range from small airplanes to supersonic transports, from slow liaison airplanes to hypersonic missiles, and from ground effect machines and helicopters to space craft. The marine vehicles include submersibles and hydrofoils.

There are many specialized technical areas within this engineering field. Among those in which graduates of aeronautical and astronautical engineering curricula most frequently work are: aerodynamics, propulsion, structures, flight mechanics, and guidance and control. Mathematics and physics are the foundations for these areas, and the engineer encounters many complex and challenging applications of these disciplines while solving his problems. Often, he must use high-speed computing machines, and most of the data he uses and the proofs of his theories are derived from laboratory and flight tests.

Man's conquest of space and the oceans is introducing new problems which require the most recent advances in engineering to solve. Also, the design of supersonic transports and vertical rising aircraft, to name only two of several new airplane types, presents major engineering problems. Therefore, engineers in this field have opportunities to work in many challenging areas on very interesting projects.

2. *Agricultural Engineering* is the branch of the engineering profession which serves agriculture through the application of basic engineering principles to problems encountered in the agricultural industry. These may involve design, development, maintenance, and applications of (1) gasoline, diesel, and electrical farm power units and machinery, (2) farm buildings, (3) equipment for crop processing and handling, such as crop driers and feed grinders or conveyors, and (4) land improvements centered about drainage, irrigation, and erosion control. The agricultural engineer in industry or in public works, with his sound engineering education added to his understanding of and appreciation for the problems of agriculture, is well prepared to apply his knowledge to the solution of engineering problems in agriculture.

3. *Ceramic Engineering* deals with the development of engineering materials and products formed from naturally occurring or synthetic inorganic materials whose characteristic usefulness is derived by high-temperature processing.

Traditionally the ceramic engineer has been thought of as working in the process industries producing glass, refractories, clay products, abrasives, cement and lime products, etc. Although these industries constitute the major part of the ceramic industry, more recently the ceramic engineer's potential employment has expanded to all industries in which ceramic materials are used in design, manufacture, or in combination with other materials to produce a specific product or function. These latter industries include the electronics industry, which utilizes ceramic dielectric and magnetic materials, and the aerospace industry, where ceramic materials play a key role in many applications.

Many ceramic engineers are involved with

This feed-metering device delivers grain to a dairy cow on the basis af its water consumption. As the caw drinks, a float in the trough (left) draps and starts an electric matar which delivers a pre-determined rate af feed ta the feed trough (right). Water flow and feed flow start and stap together.

studies of the behavior of ceramic materials in special environments. These applications invariably include high temperatures but may also include special environmental conditions to which the ceramic material is uniquely suited, such as radiation in a nuclear reactor, slag attack in a metallurgical process, or the rarefied atmospheric conditions of the thermal shield of a re-entry vehicle. The concept of utilization of materials both from a design and property viewpoint must therefore be a part of his academic background.

The ceramic engineer, in short, serves as a high-temperature materials specialist in a modern engineering team devoted to research, development, operation, or sales. He must not be solely preoccupied by analysis, but must also be able to synthesize new ceramic materials, processes, and products.

4. *Chemical Engineering* involves the development and application of manufacturing processes by which raw materials are changed in chemical composition and physical form to products for industrial and commercial use. Some of the end products of chemical engineering are synthetic fabrics, high-energy fuels, drugs, plastics, fertilizers, synthetic rubber, paints, enamels, food products, pulp and paper products, and petroleum products. A chemical engineer must have a thorough knowledge of chemistry to understand how matter changes its composition, a thorough knowledge of physics to understand the properties of matter, and the engineering ability to transform this knowledge of chemistry and physics to useful end products. The industries in which the chemical engineer is employed are such that scientific and technical compe-

A student is shown here collecting naturally occurring radon emanating from the soil. The radioactive gas is being used as a tracer in atmospheric diffusion studies.

tence are not merely useful but the key to success as a supervisor or a manager.

5. *Civil Engineering* represents a broad field which can be divided into four major areas: structural engineering, transportation engineering, sanitary engineering, and hydraulic engineering. Each involves planning, design, construction, and in some cases operation and maintenance.

a. Structural engineering concerns itself with bridges, buildings, dams, retaining walls, tunnels, subways, towers for transmission lines, radio, television, and many other similar problems. The design of such structures involves complex theoretical studies and often the use of high-speed computers. Provision of adequate foundations for above-ground structures is an important consideration, and in recent years it has developed a new specialized field of study, known as soil mechanics and foundation engineering.

b. Transportation engineering concerns itself with the vast networks of highways, railways, waterways, and airfields. The civil engineer is responsible for the design, construction, and maintenance of the highway and railway systems; for the design and construction of harbors and dock facilities, and of inland waterways; and for the runways, control towers, and buildings for airfields. He deals also with the problem of highway traffic control.

c. Sanitary engineering concerns itself with the development and maintenance of a healthy environment for people. This involves provision of a safe and adequate supply of water for human use and a sufficient quantity of water of proper quality for the many industrial requirements. It also involves determination of the causes and the remedies for air pollution, the prevention of industry-related diseases, and provision of safe and healthful surroundings at work. Finally it includes the safe disposition of waste materials of all kinds and the prevention of pollution of our water resources.

d. Hydraulic engineering concerns itself with the control and transportation of fluids. Reservoirs are created by the building of dams to store water for power generation, water supply, flood control, and irrigation needs; power plants are built for the generation of electricity; conduits and canals are constructed to distribute the water for irrigation and water supply purposes.

Work in any one of the subdivisions may involve work in one or more of the others, in some other branch of engineering, or another field of science.

6. *Electrical Engineering* is an extensive technical domain. There are two major fields in electrical engineering: the processing of information as by communication systems, computers, controls, measurements, etc., and the generation, distribution, and utilization of power. In the former field, rapid development is taking place in the area of solid-state electronics, radiation, switching, and information theory. The latter is a field of great economic importance where continuing development is taking place in such areas as new methods of generation, extra-high-voltage transmission, and the application of automatic controls. By pursuing a common core of basic courses, the electrical engineering student learns the general principles which enable him to understand and do engineering work in such diverse fields.

There are many positions in the field of electrical engineering which can be filled only by persons holding advanced degrees. Therefore, superior students usually are encouraged to continue their studies beyond the bachelor's degree. Yet any good student who earns the bachelor's degree can reasonably expect to receive many offers of interesting and challenging employment with excellent rewards.

7. *Engineering Mechanics* provides the foundation upon which engineering methods and procedures are based. The principles of mechanics underlie the theories and analyses of structures,

Students of Highway Engineering are doing research on the strength characteristics of soil aggregate mixtures on road surfaces.

fluid flow, the motion of bodies (including aircraft and missiles), and many other important engineering topics. The engineering mechanics curriculum emphasizes the basic sciences: mathematics, physics, and chemistry; as well as the engineering sciences: mechanics of solids, fluid flow, thermodynamics, electrical theory, and the nature and properties of engineering materials. Graduates with a background in mechanics can fit into any industry to solve new problems and work with scientists and engineers from other fields, and are particularly well qualified for careers in research and development as well as for advanced graduate work.

8. *General Engineering* combines a sound education in the engineering sciences with experience in analysis and design synthesis, and provides an opportunity for wide choice in defining a nontechnical field of concentration. As a result, general engineers are in demand to join or lead design teams for interdisciplinary or other special projects involving more than one technical field or subject matter.

While well equipped for professional practice in production or design, general engineering graduates are particularly well prepared for eventual management and executive leadership, as well as for such immediate roles as engineering sales and marketing. These assignments often include design, technical service functions, publications preparation and public relations work or writing, and, with legal training, such engineering-related activities as contracts and labor or patent negotiations and law.

An experimental remote-controlled mower has been developed for use on steep slopes. The mower is cable controlled, is small enough to be transported by a pick up truck, has a low center gravity, and is instantly reversible. A one-cylinder gasoline engine powers the cutter and drives the mower through an electric drive.

In addition, graduate programs and careers are open in business administration, in labor relations and arbitration, in such engineering-related sciences as geology and meteorology, and in the several standard professional fields, especially mechanical engineering, civil engineering, and engineering mechanics. Women as well as men can perform effectively in many of these positions, particularly in areas such as project design, statistical analysis, computer programming, human engineering design, atmospheric science, and publications preparation.

Flexibility and freedom in elective specialties are major advantages of the general engineering curriculum, and sustained demand has produced five formal options or special fields of concentration. These include engineering administration, engineering sales, engineering publications or journalism, engineering law, engineering geology, and engineering meteorology. Numerous other programs are acceptable, however, and can be arranged as integrated approaches to challenging careers.

9. *Industrial Engineering* is concerned essentially with the cost and production of goods according to a strict schedule. It is concerned with coordinating men, materials, machines, and money to the end that a product of the quality specified by the designer can be produced at a minimum cost, at a time desired by the buyer. It involves planning the organization, analyzing the product in terms of manufacturing procedures, selecting equipment, supplying special tooling, determining the plant layout and materials handling means, establishing work methods and output standards, studying wage payment systems, and setting up methods of quality control. Modern industry is highly mechanized, so that the industrial engineer must be essentially a mechanical engineer with a background in management, economics, and accounting. Because the human element is a major factor affecting his plans, it is also desirable for him to have a good understanding of personnel management, psychology, and sociology.

10. *Mechanical Engineering* deals with the generation and transmission of power, and with the design, construction, operation, and testing of all kinds of machines. In the transportation field alone the mechanical engineer deals with marine, railway, automotive, and aircraft equipment. In other fields

his work ranges from machine tools, engines, turbines, refrigerators, air conditioners, heating and ventilating plants, nuclear power installations, and guided missiles. The mechanical engineer serves in various capacities in industry. He may be engaged in research in fundamental properties or processes, development of new machines or processes, production work, management of processes, and sales engineering. Many also serve as consultants and teachers.

11. *Metallurgical Engineering* is primarily distinguished from other fields by its emphasis on materials rather than on machines and structures. A metallurgist, then, has a basic interest in the design, processing, and testing of metallic engineering materials. The metallurgical field can be divided into two broad areas: extractive metallurgy, dealing with separation and purification of metals from their natural states; and physical metallurgy, involving the nature, structure, treatment, and properties of metals and alloys. The metallurgist must study the factors which control the properties of metals, and use this knowledge to provide the right metal processed in the right way to obtain the best performance for any particular application. Thus, the metallurgical engineer is essential to all industries producing metal products or using metals in their manufacturing processes.

12. *Mining Engineering* covers the removal of useful minerals, both metallic and nonmetallic, from the earth's crust; their concentration, cleaning, or other treatment; and their processing into a marketable product. Mining engineers are concerned with finding mineral deposits, such as asbestos, iron ore, coal, or petroleum, exploring the size and evaluating the quality of such beds, determining whether profitable mining is possible, and choosing a method for extracting, recovering, and treating the mineral concerned. Mining engineers also select or design the processing equipment, supervise the erection of the plant, and control the operation of the extraction and treatment facilities. Some mining graduates cover the whole range of this kind of activity, while others confine themselves to a single aspect or specialty.

13. *Petroleum Engineering,* a variation of mining engineering, centers around the development and exploitation of oil and natural gas reserves.

Petroleum is an important source of energy. Even after it is replaced by other types, it will always be needed as a lubricant and as a raw material for the petrochemical industry. The United States is the major producer and user of petroleum and hydrocarbon products, for which both important sources and markets exist in Illinois. Although the petroleum industry offers positions for engineering and science students in almost all categories (especially mining, mechanical, electrical, and chemical engineers, and physicists, mathematicians, and geologists), there is a continuing demand for qualified petroleum engineers to carry out special and responsible tasks.

14. *Nuclear Engineering* is concerned with applying the concepts and devices of nuclear physics to engineering problems. The investigation and use of nuclear particles and the reactions between them have constituted a major research activity of modern physics. Begun in the 1930's, this research has led to the chain reaction, the atomic pile, to fission and fusion weapons, and to nuclear power plants. Only a start has been made in forecasting the career potential of this rapidly expanding technological frontier for the young men and women planning to enter college now and in the future.

Nuclear engineering requires the solution of complex problems; success in this field depends upon cooperative effort and effective communication with people. Thus a solid secondary-school background in English, mathematics, and physics is essential. Though this emphasis on basic training and on the fundamental sciences in college may seem a long deferment of specialization, it is realistic in terms both of employment and career demands.

Attractive careers in nuclear science and engineering are open to broadly educated, energetic, imaginative men and women with varied interests. Nuclear engineering as a career requires graduate training. It can be entered through undergraduate preparation in physics, engineering physics, chemistry, or one of the established engineering disciplines. With an appropriate background and high academic performance during his college years, a student is very likely to be given financial support for his graduate program, either in the form of fellowships or of teaching and research assistantships.

15. *Engineering Physics* is an increasingly important curriculum because of the rapidity with which new discoveries in basic science are being applied to practical problems. This development has in fact produced a new type of engineer, or scientist-engineer, who is in effect a physicist primarily interested in applied problems.

In the engineering physics curriculum, therefore, the technical studies consist almost entirely of basic

subjects: mathematics, chemistry, classical mechanics, electricity, optics, atomic and nuclear physics, quantum mechanics, thermodynamics, and statistical mechanics. Laboratory experience in advanced electrical measurements and in modern physics experiments provides an enriching supplement. Many students emphasize one of the engineering disciplines by means of elective courses.

With a bachelor's degree, the engineering physicist has many opportunities for employment, but the most exciting prospects await students who have the master's or doctor's degree in physics. With graduate study, the field is almost unlimited: basic research, advanced engineering of almost any type, operations research — all are open to the physicist who holds the doctoral degree.

Few engineering curricula can match engineering physics for flexibility in career opportunities at the bachelor's level; it is probably safe to say that none can exceed the wide range of possibilities available to the Ph.D. physicist. Students who have the requisite ability in mathematics and physical theory are, therefore, encouraged to plan for graduate study in engineering physics whenever possible.

SPECIAL FIELDS

Other branches of engineering are recognized, and in certain parts of the United States they have attained much industrial importance. Examples are geological engineering and textile engineering. Throughout the country, architectural engineering as an offshoot of architecture also plays a considerable role.

INFORMATION ON ENGINEERING CAREERS

FOR YOUNG PEOPLE

1. *Engineering as a Career,* by Ralph J. Smith. McGraw-Hill Book Company, Inc., New York, New York, 1962, 365 pages. Excellent description of what an engineer is and does.
2. *After High School — What?* Engineers' Council for Professional Development, 345 East 47th Street, New York, New York 10017, 5 pages, 3 cents each.
3. *Need Financial Aid for College?* Engineers' Council for Professional Development, 345 East 47th Street, New York, New York 10017, 5 pages, 3 cents each.
4. *Your Career in Industry as a Scientist or Engineer.* Education Department, National Association of Manufacturers. Published and distributed as a public service by the National Research Bureau, Inc., 221 North LaSalle St., Chicago, Illinois 60601, 24 pages, 20 cents.
5. *Engineering — A Creative Profession.* Engineers' Council for Professional Development, 345 East 47th Street, New York, New York 10017, 1963, 30 pages, 25 cents.
6. *The Road to Graduate School,* prepared by the University of Illinois Chapter, Tau Beta Pi, for the Committee on the Development of Engineering Faculties, American Society for Engineering Education. Available on request from Dean W. L. Everitt, College of Engineering, University of Illinois, Urbana 61803.

FOR WOMEN INTERESTED IN ENGINEERING

1. *Women in Engineering,* edited by Patricia L. Brown. Society of Women Engineers, 345 East 47th Street, New York, New York 10017, 1958, 40 pages, free.
2. "Women in Engineering," by Alice K. Leopold, Assistant to the Secretary of Labor and Director of the Women's Bureau, U.S. Department of Labor. *American Engineer,* August, 1959, pages 31-34.

FOR STUDENTS INTERESTED IN TECHNICIAN TRAINING

1. *Accredited Curricula Leading to First Degrees in Engineering Technology.* Engineers' Council for Professional Development, 345 East 47th Street, New York, New York 10017, 8 pages, 25 cents. Contains a list of thirty-two accredited technical institutes.
2. *The Engineering Technician.* A publication of the Technical Institute Division of the American Society for Engineering Education. Available from the American Society for Engineering Education, University of Illinois, Urbana, Illinois 61803, 1963, 25 cents.
3. *Can I Be a Technician?* General Motors Corporation, Educational Relations Section, General Motors Technical Center, Warren, Michigan 48090, 16 pages.
4. *Can I Be a Draftsman?* General Motors Corporation, Educational Relations Section, General Motors Technical Center, Warren, Michigan 48090, 15 pages.

(University of Illinois guidance publications are listed on the inside back cover of this bulletin.)

A university should be a place of light,
of liberty, and of learning.

DISRAELI

PART IV · THE UNIVERSITY OF ILLINOIS COLLEGE OF ENGINEERING

The architect's model shows how the Chicago Circle Campus will look upon completion of construction.

OBJECTIVES

What grades do you need to pass at the University of Illinois? A "C" — which is, technically, 70 per cent effort. If a 70 per cent effort will allow you to pass, why do better? Why should anyone use more than 70 per cent of his potential? Imagine how reassuring it would be to board a plane, for instance, which had this sign: This plane is guaranteed to be 70 per cent safe.

The College of Engineering stresses these aims — aiding students to think clearly and accurately, giving them the fundamentals of sound engineering, and affording them opportunities to put into effect the doctrine that one of the engineer's main functions is to contribute to effective practical action. All this implies treating the student as an individual and encouraging his initiative and self-reliance.

The College, then, emphasizes a thorough grasp of the engineering method and of basic laws and principles, rather than mere familiarity with processes that may change in time and vary from place to place. The College also urges every student to begin gaining a comprehensive view of the economic and social world in which he lives, and an understanding of his place in it, as well as a firm grasp of scientific and technological fundamentals. It encourages him to take full advantage of the resources of the large university to which the College belongs. Finally, administrators and teachers proceed on the belief that the engineer's knowledge, skills, and judgments are of little avail unless they are communicated to others and serve as the basis for action.

These basic policies have many results: small classes and individual contact with instructors; an effective system of faculty advisers; student participation in research programs where possible; no sharp separation between a staff member's teaching and research but, instead, stress on the desirability of his engaging in both activities; and a continuous appraisal, by the departments and the College, of methods of teaching and counseling employed.

In addition the College considers that its obligations include helping the student to find a position in industry or government which will utilize his specific abilities to the best interest of the student himself, of his employer, and of society.

AREAS OF SPECIALIZATION

The College of Engineering offers programs in the following curricula:

Aeronautical and Astronautical Engineering
Agricultural Engineering
Ceramic Engineering
Chemical Engineering
Civil Engineering
Electrical Engineering
Engineering Mechanics
Engineering Physics
General Engineering
Industrial Engineering
Mechanical Engineering
Metallurgical Engineering
Mining Engineering
Nuclear Engineering
Theoretical and Applied Mechanics
Combined Engineering-Liberal Arts and Sciences Program

RECOGNITION OF OUTSTANDING ABILITY

To recognize and encourage excellence in scholarship by outstanding undergraduates, the College of Engineering has established an Honors Program. This program is open to students in any engineering curriculum and offers additional opportunities

for advancement, individual selection of courses, plus experienced and careful guidance through personal contacts with faculty members. The Honors Program is open to entering and advanced students who meet the requirements. At the end of each semester, a list of the program's participants is published; names of newly eligible students are also included.

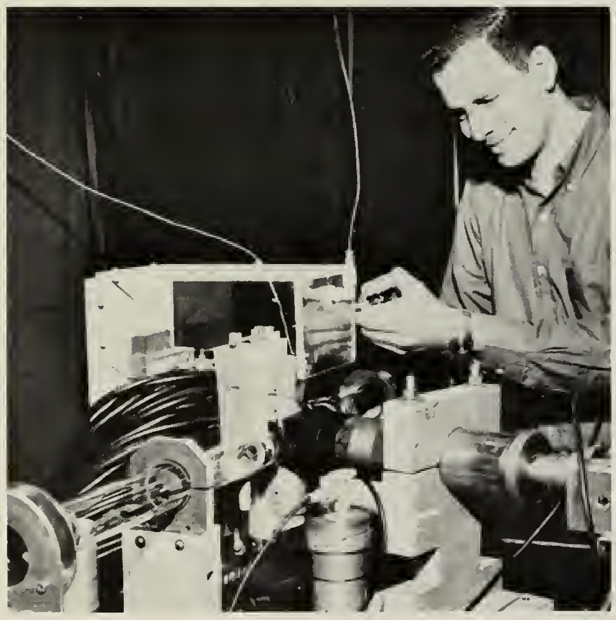
THE COLLEGE OFFICES

The offices of the Dean, the Director of the Engineering Experiment Station, the Associate Dean, the Assistant Deans, the Director of Engineering Publications, and the Placement Director are on the first floor of Civil Engineering Hall, the building directly across from the Illini Union.

THE ENGINEERING LIBRARY

The University Library's resources for study and research are outstanding; its present collections on the Urbana campus exceed 3,000,000 volumes. In addition to the General Library, thirty-two departmental collections make specific information available at locations convenient for users. As a source of information, the Library plays an important part in the teaching and research activities of the College of Engineering. The field of technical knowledge is now so wide in scope that only a small part of the material can be covered in class instruction, and reference to the literature is an essential supplement.

Here, a student is checking a capocitor bonk which is used for the production of very high-density plosmas.



The Engineering Library contains more than 88,000 volumes, including long runs of bound technical society publications, trade journals, engineering serials issued by state, federal, and foreign governments, and numerous sets of reports from research laboratories and experiment stations in this and other countries. Also, there are complete sets of the important indexes to technical periodicals, as well as abstracts and digests covering the engineering field. In addition to the Engineering Library, located in Civil Engineering Hall, the Physics, Mathematics, Ceramics, and Chemistry Libraries are nearby and readily available to engineering students.

JETS — ILLINOIS STATE HEADQUARTERS

The state headquarters for the Junior Engineering Technical Society in Illinois is in the Transportation Building on the University of Illinois campus. The office provides coordination for all JETS chapters in Illinois, publishes a newsletter, helps organize new chapters, provides an answering service for technical questions, and conducts a two-week summer program on campus for high school students, among other activities.

CHICAGO CIRCLE CAMPUS

The University of Illinois has recently completed the first phase of an entirely new campus in Chicago. This branch of the University, the Chicago Circle Campus, provides facilities for instruction in engineering, liberal arts and sciences, business administration, architecture and art, education, and physical education.

Though a substantial portion of this new campus is already completed, additional construction will continue over a period of several years in order that instructional facilities may keep pace with ever increasing enrollments.

The various fields of study offered at the Chicago Circle Campus are essentially the same as those presented in Urbana; credits may be transferred between the two institutions. An engineering

student at the Chicago Circle Campus may obtain the necessary courses to allow him to transfer and complete his degree work at the Urbana campus. Alternatively, as new laboratories now under construction are completed, students in engineering may take their entire course of study and receive their engineering degrees at the Chicago Circle Campus.

The facilities which have been completed already, as well as those to follow very soon, provide the most modern and effective means available for student instruction. All buildings on the new campus are entirely air-conditioned. Classroom sessions are held in numerous buildings designed especially for this purpose. Large lecture halls are provided in the Lecture Center under the Great Court of the campus. Closed-circuit television studios are available and the most up-to-date devices for improved teaching operations have been installed.

All of the laboratories for the engineering and science courses are housed in the huge Science and Engineering Laboratory Building. The Computer Center is also located there. Numerous laboratories for the study of chemistry, biology, geology, and physics have been completed and equipped. Many more will be provided in the construction program now under way.

Laboratories for the study of all engineering subjects are located adjacent to the science laboratories in this building. Such an arrangement promotes a close relationship between the engineer and the scientist. Engineering students carry on their experimental work and project activities in laboratories designed along new and improved lines. For example, there are laboratories which are devoted to the study of the properties and behavior of all types of *materials*. Other laboratories are provided in which the conversion and control of all types of *energy* are studied. Extensive facilities are available for students to carry out experiments on the processing of all forms of *information*. Laboratories for the study of the behavior of simple and complex *systems* are available. Regardless of whatever professional field (e.g., civil, mechanical, electrical) of specialization the student may follow after his graduation, and regardless of whatever the nature (e.g., research, production, sales) of his ultimate work, the engineering student at the new campus will pursue his academic program on the basis of these *functional* areas of materials, energy, information, and systems.

The University Library, located at the west end of the Great Court, is designed to hold over 1,000,000 volumes. In addition, a large number of technical reports, journals, magazines, and other periodicals are housed there. Considerable space and extensive facilities are provided for students to study individually or in small groups.

The Illini Union, situated at the east end of the Great Court, consists of an eight-story building and an adjacent three-story structure. These buildings contain complete recreational facilities, lounges, reading rooms, conference rooms, and dining rooms. In addition, the Union contains a large bookstore in which school supplies, books, and many other items may be purchased.

There are numerous and diverse activities and organizations on the Chicago Circle Campus, and all students are encouraged to participate in these extracurricular activities. A comprehensive intramural and varsity sports program is administered by the Division of Physical Education. A newspaper is published by the students. Field trips to Chicago-area industries are scheduled frequently for students enrolled in the engineering curricula. The College of Engineering maintains a student placement service to assist students to find part-time employment during the school year as well as full-time jobs during the summer months.

Detailed information about the various curricula and facilities of the College of Engineering at Chicago Circle may be found in the official catalog. A copy may be obtained by writing to either the College of Engineering or the Office of Admissions and Records, University of Illinois at Chicago Circle, P.O. Box 4348, Chicago, Illinois 60680.

REQUIREMENTS FOR ADMISSION

Engineering now requires a stronger background in mathematics and science than ever before. It is important, too, for the engineer to have an understanding of men and society, which can be developed by the study of the social sciences and the humanities. High schools are well prepared to give students a background in languages, social sciences, mathematics, the sciences, and English. A student who aspires to become an engineer should make certain that he takes as many of the above mentioned courses as time allows and his high school offers.

These requirements will give the student the necessary background for almost all fields of study in any university. Meeting these requirements will give the student not just a preparation for engineering, but will prepare him for college whatever his area of study will be.

The University of Illinois College of Engineering requirements specify only the minimum work that a prospective engineer is expected to do in his high school career. These requirements are not intended to limit the level of achievement of the talented and ambitious student.

Though entrance requirements are expressed in terms of units of credit, the mere accumulation of credits is not enough. To be a successful engineering student, the high school student must know and understand his high school work.

Subject	*Required Units*	*Recommended Additional Units*
English	3	1
Algebra[1]	2	
Plane Geometry	1	
Trigonometry[1]	½	
College Preparatory Mathematics		as available
Science and Social Studies[2]	4	2
Language[3]	2	as available[4]

[1] Students who have only one unit in algebra and one unit in plane geometry may be admitted on condition that the deficiency is removed in the first year.

[2] One or more units must be in each of these areas. Botany and zoology are acceptable as one unit of science but General Science may not be used to meet this requirement.

[3] Required language must be two units in one language. Students deficient in language may be admitted on condition that the deficiency be removed during the first two years.

[4] It is recommended that additional credit be earned in the same language that was presented for entrance credit. However, if the two required units of language are Latin, the additional credit should be in a modern language.

EXTRACURRICULAR ACTIVITIES

A college education should give you more than knowledge and the development of mental ability. Equally important are the growth of a personality which inspires confidence, and the development of friendships.

The most pleasant way to develop a fine personality and to find friends is to take part in extracurricular activities. Participation in these activities will help you relax from the tensions and strains of day-to-day work, as well as give you professional insight.

There are many all-campus activities at the University of Illinois, including WPGU, the student operated radio station, *The Daily Illini,* student newspaper, Student Senate, and sports, to name a few. In addition, there are many activities organized specifically for the engineering students; these are described below.

STUDENT PROFESSIONAL SOCIETIES

Every student is encouraged to take part in the activities of the student branch of his professional society. The twenty-one professional groups having active student branches at Illinois are:

The American Ceramic Society
The American Foundrymen's Society
The American Institute of Aeronautics and Astronautics
The American Institute of Chemical Engineers
The American Institute of Industrial Engineers
The American Nuclear Society
The American Society of Agricultural Engineers
The American Society of Civil Engineers
The American Society of Mechanical Engineers
Engineering Mechanics Society
Illinois Society of Construction Engineers
The Illinois Society of General Engineers
The Illinois Society of Professional Engineers
The Institute of Electrical and Electronics Engineers
Institute of Traffic Engineers
The Mineral Industries Society
The Physics Society
The Society of Automotive Engineers
The Society of Petroleum Engineers
The Society of Women Engineers
Synton (Amateur Radio)

Most of these activities are related to a particular field of study. Nearly all of them are designed to promote interest in the "parent" professional group, to advance professional spirit and ethics, and to provide a meeting place for students, faculty, and practicing engineers. The monthly or biweekly meetings ordinarily have programs featuring prominent speakers. Most societies also sponsor picnics, informal gatherings, and ball games throughout the year. Membership, which is entirely voluntary, is open to all class levels.

HONOR SOCIETIES

In addition to the professional societies, two honor societies are open to engineering students

from any department. Many departments also have honor societies restricted to members in their curricula.

Alpha Epsilon — Agricultural Engineering
Alpha Sigma Mu — Metallurgical Engineering
Chi Epsilon — Civil Engineering
Eta Kappa Nu — Electrical Engineering
Gamma Epsilon — General Engineering
Keramos — Ceramic Engineering
Phi Lambda Upsilon — Chemical Engineering
Pi Tau Sigma — Mechanical Engineering
Sigma Gamma Tau — Aeronautical and Astronautical Engineering
Sigma Tau — all-engineering
Sigma Xi — Scientific Research
Tau Beta Pi — all-engineering

Most of these are national. Since they are organized primarily to recognize and promote scholarship, members are chosen by ballot and must have a minimum scholastic standing to be eligible.

THE ENGINEERING COUNCIL

The Engineering Council consists of two representatives from each member society, two representatives from the *Technograph*, the Chairman of St. Pat's Ball, the Chairman of the Engineering Open House, and the Chairman of the Knights of St. Pat. The Council assists with freshman orientation, sponsors high school revisitation in conjunction with the Engineering Open House, and selects students to sit on College faculty committees. In addition, the Council coordinates the activities of the professional engineering societies, promotes the interest of all engineering students in extracurricu-

The ossociote editor ond o volunteer student "secretory" ore preporing on orticle for the *Technograph*. (Photogroph by Don Bissell.)

lar activities, and supervises such functions as the St. Pat's Ball and the Engineering Open House.

THE ILLINOIS *TECHNOGRAPH*

Once a month the students in the College of Engineering publish the *Technograph,* a magazine dealing with new developments and trends in the University of Illinois College of Engineering. All work on the magazine, including writing, editing, cover drawings, page layouts, business correspondence, and advertising and subscription sales, is done by undergraduates, although staff positions are not limited to engineers.

The magazine contains articles on engineering research programs being conducted on campus, engineering student activities, and topics of general student interest. Published October through May, the *Technograph* serves the College of Engineering by publishing student views and other material prepared by students and, on occasion, faculty members.

ENGINEERING OPEN HOUSE

The Engineering Open House is a student-organized and staffed two-day presentation of exhibits, facilities, and educational information about engineering and the College. The displays are intended to help orient the many thousands of high school students who attend each year. Some of the displays are amusing, and all of them are informative. The College of Engineering invites teachers, parents, and interested persons from all parts of Illinois and adjoining states to take advantage of touring the facilities. The Open House is held on a

This visitor at the Agriculturol Engineering section of Engineering Open House moy be young, but he olready looks determined to be on engineer.

Friday and Saturday in early spring; the exact dates are announced in the fall preceding the event.

MISCELLANEOUS ACTIVITIES

St. Pat's Ball is one of the special social events for the engineering students. A high point in the festivities is the appearance of "St. Pat," who initiates twelve senior engineering students who have been outstanding in extracurricular activities into the Order of the Knights of St. Pat. The ball is sponsored by the Engineering Council, and was begun in 1910.

Social Fraternities composed entirely of engineering students are Triangle and Sigma Phi Delta.

All-University Activities are open to all students of the College of Engineering. Many students take part in athletic, social, debate, dramatic, military, and Illini Union activities. These activities include students from the entire University and are excellent places to make friends with people in all areas of study.

All such activities depend on the participation of students to make them successful. They are usually entirely student-organized and maintained. By keeping these activities alive by participating in them, you will profit by gaining self-confidence, an understanding of business procedures, social grace, personality, and friendships that will give you pleasure throughout your life.

EXTRACURRICULAR ACTIVITIES ON THE CHICAGO CIRCLE CAMPUS

Like the colleges and departments of the University at Urbana-Champaign, the Chicago Circle Campus recognized extracurricular activities as an important part of student life. Such activities are encouraged as supplements to curricular work, for their value in developing qualities of character, personality, and leadership, and for their aid in perfecting individual talents in journalism, speech and debate, music, and other fields.

Student chapters of six engineering societies are active: the American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Chemical Engineers, Institute of Electrical and Electronics Engineers, American Institute of Aeronautics and Astronautics, and the American Society for Metals. These groups are sponsored by the senior society chapters in Chicago, and there is a high degree of mutual interest between the student and senior chapters.

Nearly fifty other student clubs and organizations are recognized at the Chicago Circle, sponsoring varied social and cultural activities for the benefit of the entire student body. In self-government, working with a faculty committee on student affairs, the Student Congress is composed of four officers and fourteen representatives elected by the student body and has seven committees providing liaison with the faculty group.

In engineering, the work of the several student chapters is coordinated by an Engineering Societies Council, which plans major technical programs, social events, and annual engineering affairs of general interest, including exhibits and dinners. Engineering students also participate in sports and contribute to the various publications, thus gaining rounded extracurricular experience.

The Chicago Circle Campus participates in ten varsity sports—football, basketball, baseball, cross-country running, track, wrestling, swimming, golf, gymnastics, and tennis. By special ruling, freshmen are allowed to participate in varsity sports without violating the three-year eligibility rule. All contestants, however, must meet Big Ten Conference eligibility standards.

An extensive intramural program supplements the intercollegiate sports, and includes boxing, wrestling, badminton, table tennis, volleyball, basketball, swimming, gymnastics, handball, weight lifting, tennis, track, and softball.

Experience in journalism is provided by the weekly student newspaper, the *Chicago Illini*, and the yearbook; both are written and edited entirely by students. For the engineering group there is also the opportunity to write for and edit the Chicago Circle section of the *Technograph*.

"The time has come, the walrus said,
To speak of many things . . ."
Of engineering, college life, and
The joy that college brings.

With apologies to Lewis Corroll.

UNIVERSITY OF ILLINOIS GUIDANCE INFORMATION ON ENGINEERING

FILM

"Engineering — A Career for Tomorrow" (using electrical engineering as an example, illustrates the problem-solving method of the professional engineer). Sponsored by Eta Kappa Nu; available for loan either through Engineering Alumni Committee members or from Audio-Visual Aids Service, University of Illinois. (Nominal service charge to cover transportation.)

BULLETINS

GENERAL

Guide for New Students
Mathematical Needs of Prospective Students in Engineering (1959 Revision)
Undergraduate Study (general catalog)

UNDERGRADUATE INFORMATION PRIMARILY

Careers in Mining Engineering
Engineering Mechanics at the University of Illinois
General Engineering
Metallurgy at the University of Illinois
A Career for You in Agricultural Engineering
Honors Program in the College of Engineering

GRADUATE EMPHASIS (but useful also at undergraduate level)

The Road to Graduate School
Graduate Study and Research in Civil and Sanitary Engineering
The Betatron — Its Uses, Development, and Basic Operation

(Bulletins available free on request from the Dean of the College of Engineering)